

# STRUCTURAL DESIGN - II

## 03. Welded Connections

Kiran S R

Lecturer

Department of Civil Engineering

Central Polytechnic College Thiruvananthapuram

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# Introduction

## Welding

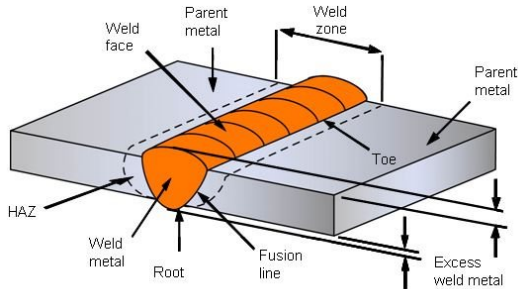
- Welding is a fabrication process whereby two or more metal parts are fused together by means of heat, pressure or both.
- A weld-pool of molten material is formed and the parts shall join together as it cools. A filler material may or may not be used.
- Unlike Soldering, welding melts the base material.





## Groove Weld

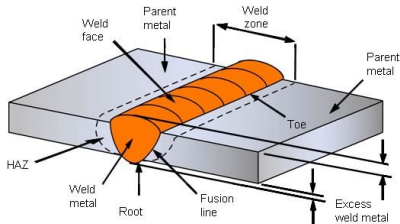
- Groove welds are used to connect structural members that are aligned in the same plane and often used in **butt joints**.
- The grooves have a slope of  $30^{\circ}$ - $60^{\circ}$ . Edge preparation becomes necessary for plates over 10mm thick for manual arc welding, and over 16mm thick for automatic welding.





## Groove Weld

- Choice between **single** or **double penetration** depends on access on both sides, the thickness of the plate, the type of welding equipment, the position of the weld, and the means by which the distortion is controlled.



## Single Penetration



## Double Penetration

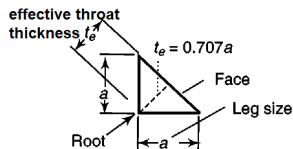
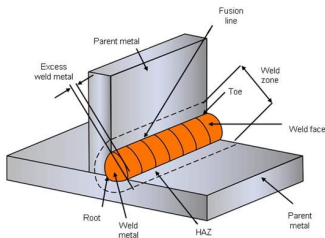




# Types of Weld

## Fillet Weld

- In connections, members generally intersect at right angles, but intersection angles between  $60^\circ$  and  $120^\circ$  can be used.
- They fail in shear.
- Most widely used due to their economy, ease of fabrication, and adoptability at site. Hence, fillet welds are used extensively (about 80%) followed by groove welds (15%).





## Slot Weld & Plug Weld

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- The diagrams illustrate two types of butt weld joints. The left diagram, labeled 'SLOT WELD', shows two plates with a U-shaped groove (slot) between them, which is filled with weld metal. Section A-A is indicated by arrows pointing to the ends of the joint. The right diagram, labeled 'PLUG WELD', shows two plates with a circular hole (plug) between them, which is filled with weld metal. Section A-A is also indicated by arrows pointing to the ends of the joint. A note above the diagrams states: 'Ends shall be semi circular'.



## Assumptions

- 1 The welds connecting the various parts are homogenous, isotropic, and elastic.
- 2 The parts connected by the welds are rigid and their deformation is, therefore, neglected.
- 3 Only stresses due to external forces are considered. The effects of residual stresses, stress concentrations, and the shape of the weld are neglected.

